

## Chapter II

# Water Pollution Control and Treatment

### Overview

Mexico faces serious challenges in providing an adequate water supply and sufficient wastewater treatment. Although water sources are abundant in Mexico, most are located far from major population areas. Not only does 70 percent of the population live in areas where water resources are scarce (mainly in Northern and Central Mexico) but these resources have in many cases been overexploited or severely polluted. At the same time, nearly 78 percent of municipal wastewater and 85 percent of industrial wastewater is untreated when discharged into oceans, rivers, lakes, and groundwater, often negatively affecting the quality of fresh water destined for human use.

Despite the progress made in developing water infrastructure within the country, there remain regional gaps in providing citizens with potable water and adequate sewage systems. Although Mexico is second behind Chile in potable water coverage in Latin America, only 88 percent of the population has access to potable water and in rural areas this percentage is even lower. Thirty-two percent of the rural population is without clean drinking water. Another serious infrastructure problem is the inadequate sewage system. Although 76 percent of the population is connected to sewage collection systems, only 23 percent of all raw sewage is actually treated. Most of the sewage is directly released into all major water bodies without treatment.<sup>1</sup>

In Baja California and Baja California Sur, provision of fresh water is especially challenging, given the region's dry climatic conditions and an expanding human population. The border region obtains most of its water from the Colorado River, while the rest of the peninsula relies on wells and desalination plants, of which there are not enough. In recent years, the U.S.-Mexican border region has experienced tremendous population, urban, and industrial growth. The annual population growth rate of Baja California hovers around 4.5 percent; already there are more than 2 million people living

in close proximity to the border.<sup>2</sup> Industry, particularly the *maquiladora* industry, has grown rapidly, creating additional demand for water-related services. The expansion of water infrastructure has mostly lagged behind urban and industrial growth.

Not only do many people in the region lack potable water, but the sewage treatment plants in the region cannot process all the raw sewage. Tijuana's sewage plant, for example, handles a total of about 25 million gallons per day and the binational International Wastewater Treatment Plant has the capacity to treat another 25 million gallons per day.<sup>3</sup> However, Tijuana's urban and industrial growth will soon produce additional wastewater that will exceed the installed treatment capacity. Other rapidly growing urban areas in Baja California and Baja California Sur are frequently faced with the almost impossible task of expanding basic infrastructure at a rapid pace.

### **Government Policies**

In Mexico, the Secretariat of Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales—SEMARNAT) is responsible for developing and implementing environmental legislation. SEMARNAT has developed a six-year environmental protection program called the National Program for the Environment and Natural Resources 2001–2006 (Programa Nacional de Medio Ambiente y Recursos Naturales 2001–2006—PNMARN). This program will be carried out with the help of the National Water Commission (Comisión Nacional del Agua—CNA), the National Forest Commission (Comisión Nacional Forestal—CNF) and the National Commission for the Protection of Natural Resources (Comisión Nacional de Áreas Naturales Protegidas—CNANF), all of which are agencies within the SEMARNAT.<sup>4</sup>

Water pollution, the protection of natural water resources, and the improvement of water infrastructure have a high priority under the current administration. SEMARNAT created the National Hydraulic Program 2001–2006 (Programa Nacional Hidráulico 2001–2006—PNH) to deal specifically with these issues. This section focuses on goals that are most likely to result in opportunities for California companies.

**SEMARNAT Policy Goals for the Year 2006 (PNH) <sup>5</sup>****Infrastructure Measures**

- To furnish 89 percent of the general population with potable water (currently 88 percent)
- To ensure that 71 percent of the rural population has access to potable water (currently 68 percent)
- To establish functioning sewage systems that serve 78 percent of the general population (currently 76 percent)


**Water Pollution and Conservation Measures**

- To significantly increase the treatment of both industrial and municipal wastewater from the current 23 percent of all raw sewage to 65 percent
- To enforce all current water regulations and standards and to collect water usage fines and fees from municipalities. Currently only 7 percent of all water regulations and standards are enforced
- To conserve existing watersheds and reservoirs and to establish 13 watershed protection committees

Plans for accomplishing these measures are based on collaboration among the CNA, the National Institute of Ecology (Instituto Nacional de Ecología–INE), and other government and non-government institutions. All finance plans and actions related to these goals will be accessible to the public, which is supposed to fulfill a “watchdog” function. The SEMARNAT will also be working with a slightly increased budget and many projects will be open for bidding to the private sector. Thus, the Mexican government hopes to attract both foreign and national public and private investment to enable it to carry out all of its envisioned projects. A list of projects planned in the Baja California-Baja California Sur region can be found at the end of this chapter.

**Municipal and Industrial Wastewater Treatment**

Municipal wastewater infrastructure investment by private sources stopped almost completely in 1995 after the peso devaluation crisis. Since most of the projects under construction or in planning had been financed through Mexican debt under variable interest rates, the surging interest rates generated bankrupted or postponed



most of them. Although the market for private wastewater infrastructure investment has begun to recover, it will take another few years until it will be back up again to its value before the peso crisis. Efforts were made to refinance some of these projects but not much has happened so far. One of the difficulties of refinancing or financing new projects is the fact that Mexican states and municipalities cannot incur foreign debt directly. All foreign credits have to be channeled through the Central Bank of Mexico (Banco de México) or through the National Bank for Public Works and Services (Banco Nacional de Obras y Servicios Públicos, S.N.C.—BANOBRAS) before reaching the municipalities. BANOBRAS, for example, then on-lends these loans in pesos at competitive market rates to municipalities, charging them spread and transaction fees to cover the exchange fee losses. These mark-ups make the foreign low-interest loans quite a bit more expensive.<sup>6</sup>

In the year 2001, the Mexican government passed legislation that allows states and municipalities to act as authorized issuers of debt (bonds). This law should make it easier for states and municipalities to obtain money without having to go through BANOBRAS or the Federal Government. Up to date, Standard & Poor's has given out bond ratings for several Mexican states and cities, including Tijuana and Baja California, but not many bonds have been issued.<sup>7</sup>

Nearly 78 percent of municipal wastewater and eighty-five percent of industrial wastewater is returned untreated to the major water bodies. The situation is only slightly better in areas with significant tourist infrastructure and activity in the U.S.-Mexican border region. The border region is a unique case since more attention to enforcement is the norm due to the proximity of the United States and the shared water bodies and groundwater sources. In general, big companies have vastly improved their discharge treatment in response to increased enforcement by authorities. Smaller companies that generate much of the industrial wastewater are often not in compliance with discharge regulations and it is probable that increasingly they will be the target of enforcement actions.

**Bajagua Plant**

Currently there is a proposal under way to construct a secondary wastewater treatment plant in Tijuana to supplement the binational International Wastewater Treatment Plant (IWTP) in the Tijuana River Valley. Known as the Bajagua project, the proposed plant would take effluent from the IWTP that has been treated to the primary level and with additional treatment it would recycle water that could then be resold to *maquiladoras* and other users in Tijuana. The Bajagua project is a private effort in response to authorization by U.S. federal legislation that is not yet funded.

**Additional Water and Wastewater Projects in Baja California**

A number of projects are planned to deal with the shortage in wastewater treatment and supply in the Municipalities of Tijuana, Mexicali, Ensenada, and Tecate. In addition, an international border aqueduct has been proposed to transfer water from the Colorado Basin to the San Diego-Tijuana region and alternative locations and costs are being explored.

***Tijuana water and wastewater projects*<sup>8</sup>**

The Japanese Bank for International Cooperation (JBIC) recently granted a substantial loan to the state of Baja California for infrastructure projects in the border region. One substantial project, which is being coordinated by the State Public Services Commission of Tijuana (Comisión Estatal de Servicios Públicos de Tijuana–CESPT), has received funds from this loan. The project consists of adding and/or increasing the capacity of approximately 1,219,528 meters of wastewater collection lines (approximately 755 miles), the construction of pump stations, the installation of sewer laterals, collectors and sub-collectors and the construction of four small, decentralized treatment/reclamation plants. Total capacity of these plants is estimated to be 665 liters/second. Work has already begun on this project and is expected to continue on through 2004. Total cost is estimated to be around US\$96 million.

Two other projects are also currently under development. Both are being funded by numerous sources including the CESPT, the U.S. EPA Border Environmental Infrastructure Fund (BEIF) and the North American Development Bank (NADBank). Both projects fall under the jurisdiction of the CESPT.

**Project A** consists of the rehabilitation of 131,000 linear meters of lines of the sanitary sewage system with pipe diameters of 20 to 122 centimeters. The project also includes the rehabilitation of the sewer network of lateral collectors and sub-collectors for a total of 51 projects. The project was approved in 2001 and work was expected to start in the same year. Total cost is estimated to be around US\$44 million.

**Project B** consists of the development of a water/wastewater master plan for the cities of Tijuana and Rosarito. It will analyze current water/wastewater system requirements and project future growth and demands in 5-year increments. The main objective of this project is to develop long-range plans that take Tijuana's population growth rate of nearly five percent under consideration. Work on this project began in 2001 and is expected to continue through the fall of 2002.

#### ***Mexicali water and wastewater projects<sup>9</sup>***

Currently, there are **two projects** underway in Mexicali that are being funded by the loan from the JBIC. **Project A** consists of the construction and expansion of six wastewater treatment plants in different parts of Mexicali. Material quotations for the project should be published in the next few months and construction is projected to begin the end of 2002. **Project B** consists of the construction, rehabilitation, and expansion of four water purification plants. Two plants will be upgraded, one plant will be expanded, and an additional plant will be constructed. Again, material quotations should be published around mid-2002 and construction should start toward the end of 2002 or early in 2003.

#### ***Ensenada water and wastewater projects<sup>10</sup>***

Money from the JBIC loan will also be used to upgrade Ensenada's wastewater collection system. Plans are to expand the sewer system through installation of collectors and subcollectors, the construction of pump stations, and the construction of a wastewater treatment plant. Material quotations were scheduled to be published in August 2002 and construction should begin toward the end of the year.

***Tecate water and wastewater projects<sup>11</sup>***

The State Commission for Public Services in Tecate (Comisión Estatal de Servicios Públicos de Tecate—CESPTE) has plans to rehabilitate and upgrade Tecate's wastewater treatment plant to produce water of sufficient quality for reuse. Material quotations were scheduled to be published in mid-2002. Work is likely to begin in September of the same year and end by mid-2003.

***The International Border Aqueduct<sup>12</sup>***

Planners in the San Diego-Tijuana region have proposed building a shared international aqueduct to deal with impending water shortages in both cities. A feasibility study for the Regional Colorado River Conveyance Aqueduct was produced by a binational group of organizations that was coordinated by the San Diego County Water Authority. Other participants in the study included: the International Boundary and Water Commission (IBWC), California State Department of Resources, Comisión Nacional del Agua, and Comisión Estatal del Agua. The study, completed in April 2002, evaluated alternative routes and cost-effectiveness. The proposed project would be approximately 100 miles long and the United States and Mexico would divide costs based on shared capacity.<sup>13</sup> Despite support from municipal leaders, the controversial project faces opposition from the Imperial Irrigation District Board of Directors<sup>14</sup> and others for political, environmental, and financial reasons. The project is currently in deliberations by water and infrastructure authorities on each side of the border, pending a binational agreement.

***Desalination Plants***

Baja California and Baja California Sur have a scarcity of fresh water due to dry climatic conditions. Other than the Colorado River, the peninsula obtains most of its water from wells and from some desalination plants. Estimates predict that there is only enough fresh water available for Baja California Sur for the next five years to meet the growing tourism industry that already has around 8,000 hotel beds. However, Baja California Sur is a popular tourist region that is experiencing rapid growth in the tourism sector and it plans to expand its hotel bed capacity substantially. Currently there are only 11 government owned desalination plants in the entire Baja California peninsula,

not nearly enough to furnish the population with potable water once groundwater resources are depleted. Many hotels under construction opt for building their own desalination plants, which means good prospects for potential investors. Since fresh water is scarce, many tourist facilities have established or will establish water reclamation and reuse facilities for landscaping and golf courses.<sup>15</sup>

Baja California authorities have also proposed the construction of a large desalination plant in the Tijuana region as an alternative or supplement to the international aqueduct. However, for Tijuana and other areas of the peninsula, the high cost of desalination is problematic. The state government also has plans to build other desalination plants, although no concrete projects are under construction.<sup>16</sup>

## **Best Market Prospects**

### ***Baja California***

Because of its geographic location, Baja California has a tradition of looking to the United States for technology, supplies, and equipment. Baja California offers very good market prospects for those companies interested in investing in the fields of wastewater treatment (both industrial and municipal), infrastructure expansion and management (construction of potable water and sewage systems), and water desalination plants (both in construction and managing). There is a strong demand for equipment and technology in these areas due to the expansion of the tourism industry in Baja California Sur and the manufacturing industry in the border region, along with population growth and urban expansion in both areas. Although some competition can be expected from European and Japanese companies, U.S. firms have a definite trade advantage not only because of NAFTA, which has led to a significant reduction of import and export tariffs, but also because of geographic location. California companies in particular can profit from their proximity to the border.

Companies with the newest technologies and competitive pricing probably possess the best possibilities for entering the Mexican environmental technology market. They must be willing to work closely with local and federal authorities and should consider a joint venture with a Mexican company or setting up a subsidiary in the



area. Investors must be aware that permit and business requirements are quite different from their experiences in California. At times, bureaucratic procedures are complex and require patience and expertise to complete. However, sometimes permits and paperwork can be expedited quickly. Currently, the best short-term business opportunities are for engineering firms, service firms, and equipment firms dealing in the products listed in Annex A at the end of this chapter.

### ***The Market in the Border Region***

The market in the border region presents slightly different conditions, especially in the field of wastewater treatment. For example, more financing opportunities are available in the border region. Specific border institutions, such as the NADBank and EPA help co-finance certain projects if they are considered low-risk and sustainable. There is also an increased willingness to support infrastructure projects in the Mexican border region when those projects will directly benefit residents on the U.S. side of the international boundary. For more details on finance opportunities, please consult Chapter IX of this manual. A list of planned projects for the border region is attached to this chapter in Annex B.

### **References**

---

<sup>1</sup> Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). 2001a. "Programa nacional hidráulico 2001–2006 (PNH)." (Cited 16 January 2002), <http://www.semarnat.gob.mx/programas/hidraulico.shtml>

<sup>2</sup> Instituto Nacional de Estadística, Geografía y Informática (INEGI). 2002. "Indicadores de la población, 2000." (Cited 8 April). <http://bc.inegi.gob.mx>.

<sup>3</sup> Saldaña, Lori. 2001. "Situación actual de tratamiento de aguas residuales en las ciudad de Tijuana B.C." Summary of CESPT PowerPoint report, handout, December, San Diego. Unpublished.

<sup>4</sup> Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT). 2001b. "Programa nacional del medio ambiente y recursos naturales 2001–2006 (PNMARN)." (Cited 16 January 2002), [http://www.semarnat.gob.mx/programas/medio\\_ambiente.shtml](http://www.semarnat.gob.mx/programas/medio_ambiente.shtml).

<sup>5</sup> SEMARNAT. 2001. a

<sup>6</sup> International Trade Administration (ITA), U.S. Department of Commerce. 1996. "Mexico Environmental Export Market Plan." Prepared by Sierra International, LLC. (Cited 28 August, 2001), <http://web.ita.doc.gov/ete/eteinfo.nsf/vwQFbyCountry>

<sup>7</sup> Morris, Kenn. 2002. "Mexican Municipal and State Bond Financing Update." San Diego. Unpublished.

<sup>8</sup> Border Environment Cooperation Commission (BECC). 2001? "Water and Wastewater Infrastructure Improvements Tijuana, Mexico: 2001–2005." San Diego. Unpublished.

<sup>9</sup> Morris, Kenn. 2002. "Water Infrastructure Development Opportunities in Baja California." San Diego. Unpublished.

<sup>10</sup> Morris. 2002.

<sup>11</sup> Padilla, Aurelio. 2002. Telephone conversation with author. San Diego, California (10 April).

<sup>12</sup> International Boundary and Water Commission (IBWC). 2002. Survey submitted by IRSC staff. San Diego, California.

<sup>13</sup> Dibble, Sandra. 2002. "New Water Crisis for Tijuana: Binational aqueduct pitched, but pipeline may not come in time." *The San Diego Union-Tribune*. (Cited 12 September, 2002)

<sup>14</sup> California Department of Water Resources. 2002. "Regional Colorado River Conveyance Feasibility Study (Binational Aqueduct). (Cited 12 September, 2002),  
[http://www.dpla.water.ca.gov/sd/environment/binational\\_aqueduct.html](http://www.dpla.water.ca.gov/sd/environment/binational_aqueduct.html).

<sup>15</sup> Valdes, Judith. 2001. "Commercial Guide for Baja California Sur." *Market Research Reports: Industry Sector Analysis*. Washington, D.C.: International Trade Administration, Department of Commerce.

<sup>16</sup> International Trade Administration, U.S. Department of Commerce. 2001. "Baja California Infrastructure-Desalting Plant." *International Market Insight Reports*. Washington, D.C.: International Trade Administration, U.S. Department of Commerce.

<sup>17</sup> BANOMEX. 1999. "Mexican Import-Export Statistics, January-December 1998." (Cited 15 November).

<sup>18</sup> Valdes. 2001.

<sup>19</sup> North American Development Bank (NADBank). 2002. "North American Development Bank Fact Sheet. Mexicali, Baja California." (Cited 16 April),  
[http://www.nadbank.org/english/projects/Infrastructure/infra\\_proj\\_frame.htm](http://www.nadbank.org/english/projects/Infrastructure/infra_proj_frame.htm).

<sup>20</sup> Banco Nacional de Obras y Servicios Públicos, S.N.C. (BANOBRAS)f. 2002. "Delegación estatal de Baja California. Proyectos ambientales." Reply to survey sent out by IRSC staff. San Diego, California (April 2002)

**Annex A**<sup>17</sup>***Most promising products for export to  
Baja California and Baja California Sur***

- Chlorinators
- Chlorine contact chambers
- Chlorine diffusers
- Cyclone/grit wash units
- Desalination equipment
- Design and engineering services
- Irrigation equipment
- Mixed sludge pumps
- Primary clarifiers
- PVC pipes
- Sprinkling systems
- Water filtration equipment
- Water meters
- Water pumps
- Water supply and distribution systems

***Most promising products for export to  
Baja California Sur***<sup>18</sup>

- 10" steel pipes
- 10" turbine pumps
- 100 hp electric pumps
- 16" steel pipes
- 18" wide pipelines
- Aeration pumps
- Chlorinator
- Desalination systems
- Inhor tank
- Oxidation towel
- Pumping tank
- PVC piping
- Triphasic electric engines
- Water pumps
- Water treatment technology

## **Annex B**

### ***NADBank Funded Projects<sup>19</sup>***

Location	Description	Date BECC Certified	NADBank Financing Approval	Construction Status	Total Cost	EPA Grant Amount	Population Benefited
Ensenada	Wastewater Treatment Plant	09-28-95	n/a	redefined	\$8,194,000	n/a	250,000
Tijuana	Parallel System/Plant Rehabilitation (San Antonio de los Buenos)	06-18-97	08-17-98	in progress	\$27,430,000	\$16,000,000	1,128,917
Tijuana	Wastewater Collection System Rehabilitation and Improvements Project	n/a	n/a	in progress	\$42,014,408	\$18,007,204	n/a
Mexicali	Sanitation Program	12-05-97	11-23-99	in progress	\$57,360,000	\$20,620,000	635,000
Tecate	Water and Wastewater Project	06-22-00	06-21-00	in progress	\$7,813,560	\$3,718,580	66,000



## Annex C

### *Other Funding Agencies for Water Projects*

**BANOBRAS** is also helping to finance various projects in the border region. One of them is an upgrade of the sewage system in the city of Ensenada that also includes a project to recycle treated wastewater. This project falls under the jurisdiction of the State Commission for Public Services of the city of Ensenada (Comisión Estatal de Servicios Públicos de Ensenada–CESPE) that is in charge of promoting it. The project has been certified by the BECC, which conducted various studies to determine its feasibility. The amount money that BANOBRAS will contribute to the project has not yet been determined.

Other projects include the construction of wastewater treatment plants, water sample testing, water monitoring, and the rehabilitation of 12 natural water wells. These projects are located in the northern Gulf region, the northern Pacific area, in San Ignacio, in Loreto and in the Valley of Santo Domingo.

National Finance Agency (Nacional Financiera, S.A.–**NAFINSA**) also finances water conservation projects by providing credits, guarantees and risk capital.